subdivision of subjects. They wanted a chair of geology and much more subdivision in the different branches of chemistry, and, first and foremost, a chair of the German language and literature. More teaching power was required and more space in which that power might exercise itself.

THE installation of Lord Balfour of Burleigh as Chancellor of the University of St. Andrews, in succession to the late Duke of Argyll, was made the occasion of a series of brilliant functions in the ancient city last week. The address delivered by Lord Balfour after his installation dealt with several important aspects of higher education, and his statement of the relationship between national progress and scientific research should be of value in showing that the work done in a progressive University is technical training of the highest kind. Referring to University studies, Lord Balfour remarked, "Besides the broad general treatment of any scientific course, the University should be enabled, as a sequel to that course, to specialise in the more advanced stages of scientific training and to encourage original research on particular lines. For this purpose the University must have full equipment and must be furnished with teachers of special attainments, who will direct and guide that original research. The students will pursue the subject as a University study, and with the view of enlarging and advancing the knowledge of their special subject. In this way only can a real advance in scientific knowledge be made; and from the students who pursue these courses—generally, I would say, post-graduate courses—we must look for the enlargement of scientific knowledge, and amongst them or as the products of their efforts we may find pioneers in the application of truly scientific method to our manufactures. A modern University must deal with the principles which lie at the root of our commercial relations, and upon which the development of manufactures must rest, just as much as it does with the principles of philology and mental philosophy. Our commercial, no less than our educational position, must be supported by a thorough training, by careful attention to principles and by imparting to young men who are to pursue commercial pursuits the power of grasping the wider aspects of the questions with which they will have to deal, and by taking care that while they obtain a training fitted to be of practical value to them in their after life, that training shall be such as will really awaken their intelligence and enable them to cultivate the inestimable qualities of judgment, of foresight and of enterprise." Upon this subject scientific and practical men are in agreement, and the demand will be met, as Lord Balfour remarked, not by curtailing the work of the Universities, or by lowering in any way their standard of scholarship or of pure science, but by enlarging their borders and extending their influence.

SOCIETIES AND ACADEMIES.

LONDON.

Physical Society, October 25.—Prof. S. P. Thompson, president, in the chair.—A paper on the variation with temperature of the thermoelectromotive force and of the electric resistance of nickel, iron and copper between the temperatures of − 200° and + 1050° was read by Mr. E. P. Harrison. In this paper the changes with temperature of the thermoelectromotive force and the resistance of nickel and iron are traced over a wide range and the singularities present in the curves representing these changes are investigated. In all experiments the same specimens of metal were used. Previous work on this subject has been performed by Tait, Fleming and Dewar, Holborn and Day, and Stansfield. In the author's experiments on E.M.F. an ordinary potentiometer method was used, the potential difference due to the thermocouple being balanced against a portion of that due to two accumulators. Before each reading a standard cadmium cell was balanced on a definite resistance in the accumulator circuit. Readings of E.M.F. of copper-nickel couples were accurate to 1·8 microvolts, while those of copper-iron couples were accurate to less than one microvolt at moderate temperatures. The heating arrangement was designed to give a uniform temperature which was measured by a platinum thermometer and recorded automatically by Callendar's recorder. The cold junctions were placed in a large test-tube full of water, the test-tube being placed in a larger vessel also containing water. The temperature of the cold junctions varied with that of the room, and all observations were reduced to cold junction 0° C. Finally, in each case, observations were taken by placing the junctions in liquid air with the platinum thermometer beside them. To prevent oxidation of the metals forming the junctions at temperatures above 500° it was necessary to exhaust the porcelain tubes which contained them. The curves for variation of E.M.F. with temperature of copper-nickel and copper-iron couples are roughly a straight line and a parabola respectively. The differences between the actual curves and a selected straight line in the former case and a parabola in the latter case have been plotted against temperature. These difference curves show that the maximum variations occur, in the case of copper-iron, at 70°, 230°, and 370°. The temperature of inversion (cold junction 0° C.) is 536° C. and the neutral point is 262° C. In the case of copper-nickel, maximum variations occur at 70° and 340°, and there appears to be a small hysteresis effect at the latter point. The temperature of inversion does not occur within the limits of the experiments, and there is no neutral point. The E.M.F. curve for a nickel-iron couple up to 700° has been obtained from the two previous experimental curves by addition. Above this temperature direct observations have been taken. This curve is nearly linear up to 900°, at which point a decrease in E.M.F. occurs. Curves of thermoelectric power have been derived from the E.M.F. curves by drawing tangents, and these show that a considerable range of the copper-iron curve can be represented by straight lines, but that the remainder is approximately parabolic. The copper-nickel power curve can be represented by bits of straight lines. The Peltier-coefficient variation curve for iron-copper is at first parabolic and can then be made up of straight lines; for copper-nickel it can be made up of bits of parabolas. Considerable difficulty was experienced at high temperatures in getting concordant results owing to chemical changes and other effects. The experiments were therefore carried out under different conditions, and the results are discussed in the paper. In the resistance experiments a potentiometer method was employed, a manganin resistance coil immersed in an oil bath being used as a standard. The resistance of nickel increases with temperature almost parabolically up to 370°, when a change of slope occurs, and the resistance increases much less rapidly and almost linearly up to 1050°. In the case of iron, the resistance curve does not change its parabolic form till nearly 800°, when it becomes linear and remains so up to 1050°. The author concludes from his paper that the thermoelectric change in nickel-copper coincides approximately with the resistance change, but that no thermoelectric peculiarity exists for iron-copper at the temperature of the iron resistance change. Mr. A. Campbell said that with purer iron the change in thermoelectric properties might correspond with the change in resistance. Dr. Knott had performed experiments on nickel in 1886 and got results similar to those of the author. His results with thick wires were different to those with thin, probably because he did not exclude air and prevent oxidation. Mr. Campbell said that he had himself made experiments upon two samples of nickel differing in resistivity, and although their temperature coefficients were also different, the change in slope of the curve connecting resistance and temperature occurred at practically the same temperature in both specimens. Their thermoelectric powers were identical up to 300°, but above they differed slightly. Dr. D. K. Morris pointed out that the thermoelectric force, the resistance and the magnetic properties should be observed at the same time. In taking a thermoelectromotive force there must be a temperature gradient, and in the interesting parts of the curves differences of magnetic properties may arise and produce discrepancies. He drew attention to the caution which must be exercised in differentiating by drawing tangents except when the curves are smooth. Dr. Morris said the connection between resistance and magnetic qualities was interesting. The temperature coefficient of resistance of a magnetic body rises with temperature so long as the body is magnetic, but reverses when the body becomes non-magnetic. He asked for information on the subject. Prof. H. L. Callendar said he had followed the research with interest, and referred to the experimental difficulties, especially at high temperatures. He should like to have said something in reply to Dr. Morris, but he was afraid the subject was a large one and might well be discussed at some future meeting. There were several points to clear up, and the fact that the curves described cannot be represented by straight lines or parabolas showed that the subject was beyond the range of a simple theory. The chairman suggested that it might be well to re-examine more carefully

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some of the curves which are accepted as straight lines and on which there is no complication due to magnetic properties. He hoped the author and others would continue working at this subject. Mr. E. P. Harrison, in reply to Dr. Morris, said he thought the number and accuracy of his observations justified him in drawing tangents to form his power and Peltier-effect curves.—A paper on asymmetry of the Zeeman effect, by Mr. G. W. Walker, was read by the secretary. Prof. Voigt predicted an asymmetry of the normal triplet, which has been verified by Zeeman. The author has considered the subject mathematically, and finds that asymmetry may arise as a second order term due to the magnetic field. The asymmetry would be more distinct the greater the field, which is opposed to the theory of Voigt. By giving numerical values to the symbols it is shown that the effect is extremely small. The author points out that his theory can provide an explanation of why a line may not be resolvable.

PARIS.

Academy of Sciences, October 21.—M. Bouquet de la Grye in the chair.—The junction of a closed network of triangulation, by M. P. Hatt.—Researches on the mummified fishes of ancient Egypt, by MM. Lortet and Hugounenq. A description and chemical analyses of mummified specimens of *Lates niloticus*. The ash consisted largely of common salt and silicates. The fish are in a wonderful state of preservation, they appear to have been enclosed in a mixture of clay and sand impregnated with a large proportion of alkaline salts, especially sodium chloride.—On a new layer of mammifers of the middle Eocene at Robiac, near Saint-Mamert, by MM. Ch. Déperet and G. Carrière. An account of the discovery of a rich deposit of Eocene vertebrates at Robiac. The species identified include *Lophiodon rhinocerodes* and *isselensis*, *Paloplotherium magnum* and *lugdunense*, *Pachynolophus Duvali*, *Anchilophus Desmaresti*, and *Hyopotamus Gresslyii*.—The limit of chemical reactions and that of the product PV in gases, by M. A Ponsot.—The diameters of Jupiter obtained with the Brunner Equatorial of the Observatory of Lyons. The influence of magnification, by M. J. Guillaume. The value obtained for the apparent diameters of this planet differed slightly according to the magnification employed. A comparison of measurements of these diameters taken at different times by various astronomers shows that this effect is general.—On secondary chains, by M. G. Kœnigs.—On groups of substitutions, by M. G. A. Miller.—On linear differential equations of the second order with algebraical coefficients of the second and third species, by M. Paul J. Suchar.—On two particular classes of congruences of Ribaucour, by M. A. Demoulin.—On the variations of magnetisation in a cubical crystal, by M. Wallerant.—Action of the pyridine bases upon the tetra-halogen quinones, by M. Henry Imbert. The action of the pyridine bases upon chloranil and bromanil has been previously described. It is now shown that the resulting compounds still possess the quinonic function, as on reducing with sulphurous acid, hydroquinones are undoubtedly produced. The isolation and properties of the pyridyl compound are described.—On the oxidation of the benzene hydrocarbons by means of manganese peroxide and sulphuric acid, by M. H. Fournier. Toluic aldehyde was obtained as the oxidation product of ortho-xylene with these reagents. One of the methyl groups in pseudocumene was similarly oxidised to the aldehyde grouping, paracymene behaving similarly. With ethylbenzene the chief product was acetophenone, a little benzaldehyde being also produced.—The action of ammonia on benzyl chloride and on the conditions of formation of benzylamine, by M. René Dhommée. A study of the conditions under which the best yield of benzylamine can be obtained.—On the amine derived from the supposed binaphthylene glycol, by M. R. Fosse.—The nitro-derivatives of arabite and rhamnite; the constitution of certain nitrous esters, by MM. Leo Vignon and F. Gerin. The penta-nitro-derivative of arabite and the penta-nitro-rhamnite both readily reduce an alkaline copper solution. The cause in the differences in reducing power of various nitro-derivatives is accounted for by the authors by supposing a difference in constitution.—On glycerophosphorous acid and the glycerophosphites, by MM. Auguste Lumière, Louis Lumière and F. Perrin. A study of the acids and salts resulting from the action of phosphorus trichloride upon glycerine.—On a new microsporidium, *Pleistophora mirandellae*, a parasite of the ovary of *Alburnus mirandella*, by MM. C. Vaney and A. Conte.—Seasonal histolysis, by M. G. Bohn.—On some ferns with heterospores, by M. B. Renault.—The development of the embryo in the ivy (*Hedera helix*), by M. L. Ducamp. In the formation of the radicular cone the central cylinder remains apart from the suspender.—Retinal inertia relative to the sense of form, by MM. Andre Broca and D. Sulzer.

DIARY OF SOCIETIES.

THURSDAY, OCTOBER 31.

ROYAL SOCIETY, at 4.30.—Special Joint Meeting with the Royal Astronomical Society, to receive Preliminary Reports on the Solar Eclipse of 1901.

CHEMICAL SOCIETY, at 8.30.—The Frankland Memorial Lecture: Prof. H. E. Armstrong, F.R.S.

FRIDAY, NOVEMBER 1.

GEOLOGISTS' ASSOCIATION, at 8.—A Conversazione in the Library of University College, Gower Street.

INSTITUTION OF MECHANICAL ENGINEERS, at 8.—Adjourned Discussion on the Second Gas-Engine Research Report by Prof. F. W. Burstall.

MONDAY, NOVEMBER 4.

SOCIETY OF CHEMICAL INDUSTRY, at 8.—The Rapid and Approximate Estimation of Free Oxygen in Sewage Effluents and Waters: Prof. W. Ramsay, F.R.S.—Phthalic Glyceride: Watson Smith.—Notes on the Manufacture of Varnish by the Pressure Process: A. J. Smith.

TUESDAY, NOVEMBER 5.

INSTITUTION OF CIVIL ENGINEERS, at 8.—Address by Mr. Charles Hawksley, President, and Presentation of Medals and Prizes awarded by the Council.

WEDNESDAY, NOVEMBER 6.

GEOLOGICAL SOCIETY, at 8.—On an Altered Siliceous Sinter from Builth: Frank Rutley—Note on a Submerged and Glaciated Rock-Valley recently exposed to view in Caermarthenshire: T. Codrington.—On the Clarke Collection of Fossil Plants from New South Wales: E. A. Newell Arber.

ENTOMOLOGICAL SOCIETY, at 8.

THURSDAY, NOVEMBER 7.

LINNEAN SOCIETY, at 8.—On the Life-history of the Black-currant Mite (*Phytoptus ribis*): Mr. Warburton and Miss Embleton.—Notes on the types of Species of *Carex* in Boott's Herbarium: C. B. Clarke, F.R.S.

RÖNTGEN SOCIETY, at 8.30.—Presidential Address: Herbert Jackson.

CHEMICAL SOCIETY, at 8.—Note on the Non-existence of a Higher Oxide of Hydrogen than the Di-oxide: Prof. W. Ramsay, F.R.S.—The Electrolytic Reduction of Nitrourea: G. W. F. Holroyd.—(1) The Constitution of Pilocarpine, III.; (2) A New Synthesis of α-Ethyl Tricarballylic Acid: H. A. D. Jowett.—The Action of Nitric Acid on Methyl Dimethylacetoacetate: Prof. W. H. Perkin, F.R.S.—(1) An Incrustation from the Stone Gallery of St. Paul's Cathedral; (2) Note on Asbestos: E. G. Clayton.—Liquid Nitrogen Peroxide as a Solvent: Prof. P. F. Frankland, F.R.S., and R. C. Farmer.

FRIDAY, NOVEMBER 8.

ROYAL ASTRONOMICAL SOCIETY, at 5.

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